ACTA PARASITOLOGICA POLONICA
VOL. VII WARSZAWA, 15.I.1959 FASC. 4

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On the structure of systematics of nematodes order *Tylenchida* Thorne, 1949

O podstawach systemu nicieni z rzędu *Tylenchida* Thorne, 1949

The systematization of the nematodes parasitic on plants has undergone a number of changes and has even now required some modification.

Micoletzky (1922) created the family *Tylenchidae* of nematodes possessing a spear in the buccal cavity. According to the structure of the spear he subdivided the family into three subfamilies: *Tylenchinae* having the spear with swellings at the base, *Diphterophorinae* having the spear with swellings distributed asymmetrically, and *Dorylaiminae* having a cylindrical spear without swellings.

Somewhat later (Baylis and Daubney, 1926) the nematodes parasitic on plants were assigned to a new familly, *Anguillulinidae* Baylis et Daubney, 1926, and split into two subfamilies: *Anguillulininae* and *Dorylaiminae*.

Chitwood et Chitwood, 1937 assigned the representatives of the family *Dorylaimidae* to the subclass *Aphasmidia* by virtue of the absence of phasmids and the representatives of the phasmided family *Anguillulinidae* to the subclass *Phasmidia*.

Thus the family *Anguillulinidae* were left with one subfamily *Anguillulininae*, one genus *Anguillulina* and the typical species *A. tritici*, as wheat nematodes were called.

In 1865 Bastian created a new genus of stiletto-armed nematodes called *Tylenchus* with the typical species *T. davainei* Bastian, 1865.

Thus, two genera *Anguillulina* Gervais et v. Beneden, 1859 and *Tylenchus* Bastian, 1865 existed for some decades of the nematodes possessing a spear and showing close diagnostic features (the similar structure of the spear and oesophagus). Some

investigators advocated the preservation of the genus *Anguillulina* but not of the genus *Tylenchus* on the basis of the priority of the former over the latter, others upheld the arrangement suggested by Filipjev.

Filipjev (1936) split the genus *Anguillulina* into a number of genera the typical species of which he assigned to the genus *Anguina* Scopoli, 1777 and thus abolished the independence of the genus *Anguillulina*. He established four groups into which he divided all those genera.

(1) Nematodes with a chitinized head, a roughly striated cuticle, a powerful but not very long spear, a tail varying in volume, a bursa always caudal. Genera: *Rotylenchus, Hoplolaimus, Pratylenchus, Tylenchorhynchus, Chitinotylenchus.*

(2) Nematodes with a head without chitinous formations, a finely striated cuticle, a tylenchoidal oesophagus. Genera: *Dolichodorus, Tetylenchus, Halenchus, Psilenchus, Eutylenchus, Ditylenchus, Anguina, Jotonchium.*

(3) Nematodes with a degenerate spear. Genera: *Neotylenchus, Hexatylus, Hemicycliophora, Macroposthonia.*

(4) Nematodes with a spear with well-developed basal swellings, an extraordinarily long body and a well-shaped smooth cuticle. Genus: *Ecphyadophora.*

All these genera were assigned by Filipjev to one subfamily *Tylenchinae.*

Thorne (1949) went even further in the arrangement of *Tylenchida.* He separated all spear-armed nematodes into one order *Tylenchida.* There are four families in his arrangement: *Tylenchidae, Heteroderidae, Neotylenchidae* and *Criconematidae.*

The family *Tylenchidae* with the subfamilies *Tylenchinae, Pratylenchinae,* and *Hoplolaiminae.* Moreover Thorne included the five genera *Eutylenchus, Atylenchus, Tylenchulus, Ecphyadophora,* and *Dolichodorus* to the family *Tylenchidae,* but was not able to assigne them into subfamilies.

In the family *Heteroderidae,* he preserved one subfamily *Heteroderinae* with the genera *Heterodera* and *Meloidogyne.*

He included the three subfamilies *Neotylenchinae, Nothotylenchinae,* and *Paurodontinae* into the family *Neotylenchidae.*

He included the two subfamilies *Criconematinae* and *Paratylenchinae* into the family *Criconematidae.*

Chitwood and Chitwood assigned the spear-armed ne-

matodes to the suborder *Tylenchina*. There are according to them three families: *Tylenchidae, Heteroderidae,* and *Criconematidae* in that suborder.

The family *Tylenchidae* with the subfamilies: *Tylenchinae, Neotylenchinae, Nothotylenchinae, Paurodontinae*. The authors write that the group of the subfamily *Tylenchinae* is not quite homogenous and includes genera fully coinciding with *Neotylenchinae* and *Nothotylenchinae* and that a revision is desirable.

The family *Heteroderidae* (according to Chitwood and Chitwood) with three subfamilies: *Heteroderinae, Hoplolaiminae,* and *Nacobbinae*.

The family *Criconematidae* with three subfamilies: *Criconematinae, Paratylenchinae,* and *Dolichodorinae*.

In the two decades following Filipjev's arrangements a great many of new species and genera of nematodes parasitic on plants were created which can no longer be confined within the present arrangement. Consequently it is natural that Thorne as well as Chitwood et Chitwood proposed the above arrangement. Both arrangements are imperfect and cannot satisfy us. In Thorne's arrangement the family *Heteroderidae* is poorly represented by subfamilies and genera. In our opinion the arrangement wrongly assignes some genera such as *Nacobbus, Rotylenchulus,* and *Radopholus* to the subfamily *Pratylenchinae*. Moreover Thorne has left a number of genera: *Eutylenchus, Atylenchus, Dolichodorus, Tylenchulus* and *Ecphyadophora* in the family *Tylenchidae* without assigning them to any subfamily.

In Chitwood and Chitwood's arrangement a number of genera: *Ecphyadophora, Macroposthonia, Eutylenchus,* and *Atylenchus* are absent and some of others wrongly assigned. It is quite illegitimate for the authors to assign the subfamily *Hoplolaiminae* to the family *Heteroderidae*.

After having got acquainted with the above arrangements and the representatives of each of the genera and on close examination of all families and subfamilies of the order *Tylenchida*, we believe that it is necessary to establish an arrangement of *Tylenchida* which would above all include all known families, subfamilies and genera of this group of nematodes, while the genera with coinciding features should be included into families and subfamilies.

First of all we separate *Heteroderata* into an suborder of its own where we assign all representatives of the family *Heterode-*

ridae. The latter show distincitive physiological characteristics; namely, their females produce a numerous progeny in comparison with nematodes representing other groups and thanks to a long-lasted evolution in this direction they have changed the body shape from vermiform to spherical (from pyriform and lemon-shaped to spherical). The females of these nematodes deposit eggs with well-developed larvae into an egg case which is not observed in other representatives of phytonematodes, and later on either change into cysts inside which there are eggs with larvae or settle in galls forming on plants and containing females, eggs and larvae.

Taking into account the biological characteristics of these nematodes and the profound changes their morphology has undergone under the influence of the external conditions of the habitat we have separated this group of nematodes and others related to them through the same characteristics into a new suborder *Heteroderata*.

Suborder *Heteroderata* Skarbilovich, 1957 *

Diagnosis: *Tylenchida*. Dimorphic forms: females with swollen body, pyriform, lemon-shaped, spherical; males with vermiform body. Females depositing their genital production — eggs with larvae, into an egg case. The progeny of the nematodes is preserved either in the female body converted previously into a cyst or in egg cases (oothecae) in galls of the roots of plants.

The family *Heteroderidae* Skarbilovich, 1947 is assigned to this suborder.

Family *Heteroderidae* Skarbilovich, 1947
Synonym: *Heteroderidae* Thorne, 1949

Diagnosis: *Heteroderata*. Dimorphic nematodes. Females lemon-shaped or spherical; males typically vermiform. There are six small papillae on the head. Spear ordinary in shape, with three well-developed swellings at the base. Oesophagus with a small oval or spherical muscular swelling behind which there are three oesophageal glands: two subventral, opening into the lumen of the oesophagus in the region of the bulbus, third dorsal, at the base of the spear.

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* First mentioned by Sandner: Sandner H. — Wrażenia z podróży naukowej do Związku Radzieckiego [Impressions from a research trip to the Soviet Union], Warszawa, Kosmos "A", 2, (25), 1957.

M a l e s with anterior single or double gonad. Two well-developed spicules. Gubernaculum present. Cirrus sac absent (except in *Nacobbus.*

F e m a l e s with single or double gonad. Vulva opening terminally, or slightly shifted on to the ventral side. Female body either changing into a cyst or not and staying in galls on the roots of the plant. Phytoparasites.

Typical subfamily *Heteroderinae* F i l i p j e v, 1934.

In this family, the nematodes of the genus *Meloidogyne* distinctly differ from those of the genus *Heterodera.* The representatives of the former provoke the formation of galls on the roots of plants and unlike the representatives of the genus *Heterodera,* their females do not change into cysts. The males of *Heterodera* have one gonad and those of *Meloidogyne* a double one. In *Meloidogyne* the moulting of the larvae of the first stage takes place in the egg, in *Heterodera* outside it.

On the basis of our exposition we propose to separate the representatives of the genus *Meloidogyne* into the subfamily *Meloidogyninae* nov. subfam.

C h i t w o o d and C h i t w o o d, 1950 created the subfamily *Nacobbinae* with the genera *Nacobbus* and *Rotylenchulus.* We are of the opinion that the genus *Rotylenchulus* should be assigned to the subfamily *Tylenchululinae,* since *Rotylenchulus* females have a body spherical in shape and half-penetrate into the roots of plants like in *Tylenchulus,* and the development of the representatives of both genera is similar. The subfamily *Nacobbinae* should be left with the single genus *Naccobus.*

In 1952 R a s k i and S h e r created the new subfamily *Sphaeronematinae* with the genus *Sphaeronema* and assigned it to the family *Criconematidae.* We believe that that subfamily should be included into the family *Heteroderidae* on the basis of the following characteristics: the female nematodes of the genus *Sphaeronema* have a body spherical in shape and deposit eggs into an egg case; nematodes with a finely striated cuticle, a small spear, while in the representatives of *Criconematidae* the cuticle is strongly striated, the spear is long, females and males vermiform, females do not deposit eggs into an egg case.

We leave these nematodes to belong to the subfamily *Sphaeronematinae* as their females have double gonads and also differ from

the representatives of the subfamily *Heteroderinae* in the mode of life; they are parasitic on the roots of perennial plants.

Thus the family *Heteroderidae* divides into five subfamilies: *Heteroderinae* Filipjev, 1934, *Tylenchululinae* Skarbilovich, 1947, *Meloidogyninae* subfam. nova, *Nacobbinae* Chitwood et Chitwood, 1950 and *Sphaeronematinae* Raski et Sher, 1952.

Table indicating the division of the family *Heteroderidae* into subfamilies

1 (6) Females short-necked.
2 (5) Nematodes not forming galls; females forming cysts.
3 (4) Females with double gonads, depositing eggs partly into an egg case; most eggs remaining in the body cavity of females or the latter laying no eggs at all. Males with well-developed alimentary and genital system, with single gonad; spicules divided, with no spicular sheath; tail blunt, short. Parasitic on annual plants . . . . . — *Heteroderinae* Filipjev, 1934.
4 (3) Females with single gonad, depositing eggs into a small egg case. Female body not forming a cyst. Males with degenerate alimentary and poorly developed genital systems. Spicules undivided, closed in a spicular sheath. Tail elongate, conic. Parasitic on perennial plants . . . . . — *Sphaeronematidae* Raski et Sher, 1952.
5 (2) Nematodes provoking the formation of galls; females not forming cysts. Females with spindle-shaped body pointed at the ends, with single gonad, depositing eggs into egg cases. Males with single gonad, with well-developed alimentary system. Two spicules, gubernaculum present. Genital bursa small, in the shape of narrow wings. Parasitic on a great number of various genera of annual plants . . . . . — *Nacobbinae* Chitwood et Chitwood, 1950
6 (1) Females long-necked.
7 (8) Nematodes very small, about 0.5 mm long. Female body partly forms a cyst. Females with single gonad; vulva opening on the ventral side of the posterior part; depositing all eggs into small egg cases. Males with degenerate spear and fairly short single gonad. Two spicules with no spicular sheaths. Male tail fairly long, pointed. Parasitic on cytrus plants . . — *Tylenchululinae* Skarbilovich, 1947.
8 (7) Nematodes large, from 0.5 to 1 and more mm long. Females with moderately long necks. Vulva in females opening terminally or slightly subterminally. Gonads in females double. Females depositing eggs into egg cases or not depositing any and keeping them within the body cavity; tail blunt, round, without protrusion. There is a vular preanal region characteristic of this group of nematodes with variously shaped folds. In males well-developed alimentary and genital systems; two spicules with no spicular sheaths. Male tail blunt, round. Parasitic on annual and perennial plants . . . . . — *Meloidogininae* subfam. nova.

Subfamily *Heteroderinae* Filipjev, 1934
Synonym: *Heteroderinae* Skarbilovich, 1947

Diagnosis: *Heteroderidae*. Body varying from spherical to pyriform or lemon-shaped. There is a small well-developed hexahedral cuticular "cap" on the head.

Females with a double gonad and a vulva situated terminally, either on an even surface or a small protrusion or elevation. Females producing jelly-like mass forming an egg case where often deposit eggs with larvae or else there is no egg case and then only larvae appear.

Males with a single long gonad reaching almost as far as the oesophagus, with a short, wide and blunt tail.

Parasitic on various plant species.

Typical genus *Heterodera* Schmidt, 1871.

Genus *Heterodera* Schmidt, 1871
Synonym: *Heterobolbus* Railliet, 1896

Diagnosis: *Heteroderinae*. Dimorphic nematodes. Female body varying in shape: from spherical to lemon-like. Males of ordinary vermicular form. Male cuticle transversely striated without lateral bands. There are small plates on male heads dividing the labial region into six sectors. Anterior part of the body somewhat extended and passing into a neck in females. Cuticle striated and varying in stucture. Female cuticle becoming thick and brown and forming a cyst. Armed with a spear consisting of three parts: anterior conic, mid cylindrical and posterior made up by three spherical swellings; spear swellings in males being anchor-shaped. Oesophageal glands consisting of three mononuclear cells situated obliquely and ventrally in the initial part of the intestine. Glands opening on to the lumen of the oesophagus, two subventral ones in the region of the muscular bulbus and one dorsal one at the base of the spear.

Males with a single fairly long gonad. Caudal extremity short, blunt. Cuticle somewhat thickened at sides. Two spicules slightly widened in the proximal part and pointed at the distal. Gubernaculum in the shape of a small plate situated dorsally to the spicules. Single papilla can be noticed on the tail.

Females viviparous, with a double gonad consisting of two ovaries, two uteri, two seminal receptacles, two ovojectors and one

vagina; vulva opening terminally or subterminally. Eggs fairly large 0.067 to 0.128 mm in length and 0.030 to 0.052 mm in width.

Some representatives of the genus *Heterodera* show not only morphological but also biological differences between each other. In one group, females have a body different in shape and showing a protrusion at its posterior extremity; they produce jelly-like stuff, and egg case, where they deposit eggs still during life-time. In the other group, females have mostly a spherical body (with no protrusion), deposit no eggs (egg-case absent), and of the genital pores come out ready-formed larvae.

Considering the above we propose to split the genus *Heterodera* into two subgenera: *Heterodera* subgen. nov. and on the basis of the shape of the female body we call the second subgenus *Globodera* subgen. nov.

Subgenus *Heterodera* subgen. nov.

Diagnosis: *Heterodera* with a body varying in shape, from lemon-like to pyriform; there is a protrusion at the posterior extremity of the body. Females with an egg-case where they deposit eggs, while the nematodes still live. There are spicules in males with one or more denticles at the distal ends.

Typical species: *Heterodera (Heterodera) schachtii* Schmidt, 1871. Other species: *H. (H.) göttingiana* Liebscher, 1892, *H. (H.) avenae* Filipjev, 1934, *H. (H.) humuli* Filipjev, 1934, *H. (H.) cacti* Filipjev et Shuurmans-Sthekhoven, 1941, *H. (H.) cruciferae* Franklin, 1945, *H. (H.) schachtii* var. *trifolii* Flik et Saabtink, 1949, *H. (H.) weissi* Steiner, 1949, *H. (H.) galeopsidis* (Goffart, 1936), *H. (H.) carotae* Jones, 1950, *H. (H.) glycines* Ichinohe, 1953, and *H. (H.) fici* Kirjanova, 1954.

Subgenus *Globodera* subgen. nov.

Diagnosis: *Heterodera* with a spherical body without any protrusion at the posterior extremity. Females have no egg-case, deposit no eggs, and the larvae come out ready-formed. Males have spicules terminated with a single point at the distal end.

Typical species: *Heterodera (Globodera) rostochiensis* Wollenweber, 1923. Other species: *H. (G.) punctata* Thorne, 1928, *H. (G.) leptonepia* Cobb et Taylor, 1953, *H. (G.) tabacum* Lownsbery B. et Lownsbery J., 1954.

Subfamily *Sphaeronematinae* Raski et Sher, 1952

Diagnosis (according to Raski and Sher, 1952): Female body subspherical, cuticle thick, showing a distinct netled pattern. Labia of the vulva with protruding convexities, their position subterminal. Males degenerate, bursa absent.

By assigning this subfamily to *Heteroderidae* we extend the diagnosis somewhat and make it more accurate in details characteristic of the family *Heteroderidae*.

Diagnosis: *Heteroderidae* (after Skarbilovich). Nematodes with dimorphic body: females spherical, males vermiform. Females with a short spear and a very well-developed oesophagus. Female gonad single. Females producing jelly-like stuff to deposit eggs into. Males with a degenerate digestive system (no spear). Gonad single, spicules narrow, thin and sheathed. Gubernaculum present. Bursa absent.

Typical genus: *Sphaeronema* Raski et Sher, 1952.

Genus *Sphaeronema* Raski et Sher, 1952

Diagnosis: *Sphaeronematinae* (after Raski and Sher, 1952). Larvae furnished with a well-developed spear. Head sclerosed, hexaradially symmetrical. Females subspherical, with a well-developed spear; there being one or two very indistinct rings near the labial region. Oesophagus very well-developed. Ovary single; uterus usually large, with thick, muscular walls. Males thin, active, with no spear; oesophagus degenerate, no bursa, spicular sheath present, testis single.

Typical species: *Sphaeronema californicum* Raski et Sher, 1952. Other species: *S. arenarium* Raski, 1956.

Sybfamily *Nacobbinae* Chitwood et Chitwood, 1950

Diagnosis: *Heteroderidae* (according to our own description). Nematodes with a dimorphic body: females with swelled spindle-shaped body, males vermiform. Nematodes with a well-developed digestive system. In females gonad single, well-developed and long. Females depositing eggs into an egg-case. In males gonad single, spicules of the tylenchoid type. Gubernaculum present. There is a small bursa in the shape of narrow wings.

The secretion of the oesophageal glands brings about the formation of giant cells and helps the formation of galls on the roots of plants.

Typical genus: *Nacobbus* Thorne et Allen, 1944.

Genus *Nacobbus* Thorne et Allen, 1944

Diagnosis (from Goodey, 1951): *Nacobbinae* with a dimorphic body: females swelled and sacciform, males vermiform. Males with small wings at the caudal end, there being one caudal papilla on either side. Females with single gonad. Nematodes forming galls on the roots of plants. Males developing directly, i.e., not inside galls.

Typical species: *Nacobbus dorsalis* Thorne et Allen, 1944. Other species: *N. aberrans* (Thorne, 1935) Thorne et Allen, 1944 (syn. *Anguillulina aberrans* Thorne, 1935), *Pratylenchus aberrans* (Thorne, 1935) Filipjev et Schuurmans-Sthekhoven, 1941, *Nacobbus batatiformis* Thorne et Schuster, 1956.

Subfamily *Tylenchululinae* Skarbilovich, 1947

Diagnosis: *Heteroderidae*. Nematodes with a dimorphic body: females pyriform, with a strongly elongate neck; males vermiform. Head with papillae, with no small cuticular „cap". Females with a degenerating digestive system. Genital system well-developed; females secreting jelly-like stuff — "egg case", where they deposit eggs with larvae. Swelled part of the *Tylenchulus* female body becoming brown and changing into a cyst. Male digestive system present. Anterior part of the female body penetrating into, the posterior keeping outside, the roots.

Typical genus: *Tylenchulus* Cobb, 1913.

Genus *Tylenchulus* Cobb, 1913

Diagnosis: *Tylenchululinae*. Nematodes with the intestine degenerated in females; anal pore not functioning. Excretory pore situated in the mid part of the body. In males caudal wings absent. Spear and oesophagus not functioning during the last moulting. Young females usually becoming parasites, their bodies becoming large and sacciform and often hanging down from the roots. Fe-

male genital tube straight, with a strong muscular vagina. Vulva situated in a deep fold; gonad single, prodelphic, bent. Development from egg to young female free in soil. Parasites of cytrus plants.

Typical and hitherto unique species: *Tylenchulus semipenetrans* Cobb, 1913.

Genus *Rotylenchulus* Linford et Oliveira, 1940

Diagnosis: *Tylenchulinae* (from Goodey, 1951). Adult males developing fast, yet not usually parasitic. Young females becoming parasitic after fecundation, penetrating into the tissues of the roots, becoming sacciform or kidneyform, frequently hanging down outside the root. Gonads double, opposed to each other, bent. Development from egg to young female effected in soil. Parasites of the roots of many plants in Hawai.

Typical species: *Rotylenchulus reniformis* Linford et Oliveira, 1940.

Subfamily *Meloidogyninae* subfam. nova

Diagnosis: *Heteroderidae*. Dimorphic nematodes: females pyriform, males vermiform. Female body not forming a cyst. The secretion of the oesophageal glands stimulates the formation of galls and giant cells in them. Females oviparous, with gonads double or single, producing jelly-like stuff, the so-called egg-case (ootheca), where they deposit all eggs, or else they do not deposit eggs and produce larvae. Males with clearly-developed lateral fin-like processes, with gonads double or single, a pair of spicules and a small gubernaculum. Caudal wings absent or underdeveloped. Nematodes bringing about the formation of galls on the roots of plants.

Typical genus: *Meloidogyne* Goeldi, 1887.

Genus *Meloidogyne* Goeldi, 1887

Synonyms: *Heterodera* Schmidt, 1871; *Caconema* Cobb, 1924

Diagnosis: (after Chitwood, 1949). *Meloidogyninae*. Nematodes with a dimorphic body. Females pyriform or spherical, males vermiform. Male head with two fin-like processes. One or two testes present. Female body soft; cuticle never changing into a stiff-skinned cyst. Vulva subterminal, with two hemispherical labia. Anal pore in the region of the hind labium of the vulva. Female

cuticle with straight transverse striae resembling finger-print in pattern in the perineal region; the pattern never resembles lace. Eggs never remaining in the female body cavity and all deposited into the mucofibrous stuff, egg-case, at the gastrulatio stage. Hatching larvae with a straight head (with no small „cap"). Nematodes bring about the formation of galls on the roots, root-crops and tubers of plants.

Typical species: *Meloidogyne exigua* Goeldi, 1887. Other species: *M. javanica* (Treub, 1885), *M. incognita* (Kofoid et White, 1919). *M. incognita* var. *acrita* Chitwood, 1949, *M. hapla* Chitwood, 1949, and *M. arenaria* (Neal, 1889).

Chitwood, Hannon and Esser created the genus *Meloidodera* and assigned it to the subfamily *Heteroderinae*. They mentioned in the generic diagnosis the presence of the features of the genera *Meloidogyne* and *Heterodera*. Females resembling *Heterodera rostochiensis* in body shape, yet the cuticle is not stained yellowish. At the same time there are bright furrows about 2 μ wide on the body surface just as in *Meloidogyne*. Anal pore moderately distant from the vulva. The pattern in the vulvar region somewhat resembles *Meloidogyne hapla* Chitwood, 1949. Spear fairly long, with large swellings, resembling *Heterodera*. Eggs remaining in the female body cavity as in *Heterodera*.

We think that the features of the genus *Meloidogyne* predominate in the genus *Meloidodera*, e.g., the presence of the „pattern" in the anovulvar region, the system of the species of *Meloidogyne* genus having been built on the basis of its structure. Accordingly we assign to the subfamily *Meloidogyninae* the genus *Meloidodera* and make the diagnosis of this genus somewhat more accurate.

Genus *Meloidodera* Chitwood, Hannon et Esser, 1956

Diagnosis: *Meloidogyninae*. Females with a swollen pyriform body with no process at the posterior extremity. Body walls thickened and hard. Spear fairly powerful. There are stippled rings between the vulva and the anus which form a "pattern" in the anovulvar region as in the representatives of *Meloidogyne*. Vulva and anus slightly shifted on to the ventral side. Females not depositing eggs into an egg-case; eggs remaining in the body cavity of the nematodes. Larva moulting in the egg. Parasites of perennial plants, forming no galls on roots.

Typical species: *Meloidodera floridensis* Chitwood, Hannon et Esser, 1956.

We think that the foreign investigators have not characterized the diagnostic features of the suborder *Tylenchata* accurately enough, and so while creating the new suborder *Heteroderata* we add to the accuracy of the diagnosis of the suborder *Tylenchata.*

Suborder *Tylenchata* Chitwood et Chitwood, 1950

Diagnosis: *Tylenchida.* Oesophagus consisting of two parts: anterior cylindrical and posterior glandular; oesophageal bulbus present or absent. Female and male body vermiform. Females oviparous, not depositing eggs into the jelly-like stuff, i.e. "egg-case", and not forming a cyst. Males with a single gonad; wings (genital bursa) at the caudal extremity. Parasites and semi-parasites of plants.

We assign nine families to this suborder: *Tylenchidae* Micoletzky, 1922, *Neotylenchidae* Thorne, 1949, *Criconematidae* Thorne, 1949, *Dolichoderidae* fam. nova, *Nemonchidae* fam. nova, *Macroposthoniidae* fam. nova, *Atylenchidae* fam. nova, *Ecphyadophoridae* fam. nova, and *Jotonchidae* fam. nova.

(1) Family *Tylenchidae* with subfamilies: *Tylenchinae* — nematodes with a tylenchoid-type oesophagus with a bulbus; genera: *Tylenchus, Ditylenchus, Anguina, Psilenchus, Tetylenchus, Tylenchorhynchus,* and *Chitinotylenchus;* subfamily *Pratylenchinae* with an aphelenchoid-type oesophagus with a bulbus, with genera *Pratylenchus* and *Radopholus;* and subfamily *Hoplolaiminae* with a finely developed anterior oesophageal bulbus, with genera *Hoplolaimus, Rotylenchus* and *Helicotylenchus.*

(2) Family *Neotylenchidae* with an oesophagus without a bulbus. Here belong three subfamilies: *Neotylenchinae* with genera: *Neotylenchus, Hexatylus, Deladenus;* subfamily *Nothotylenchinae* (oesophagus degenerate) with genera: *Nothotylenchus, Thada, Baleodorus* and *Halenchus;* subfamily *Paurodontinae* with genera: *Paurodontus* and *Stictylus.*

(3) Family *Criconematidae* — in females oesophagus with two criconematoid-type bulbi, in males degenerate. In this family there are three subfamilies: *Criconematinae* with genera: *Criconema,* and *Criconemoides;* subfamily *Hemicycliophorinae* subfam. nova with genus *Hemicycliophora* — nematodes with a very long

thin body with a finely striated cuticle; genital bursa in males; long spicules with a spicular sheath; gubernaculum present; and subfamily *Paratylenchinae* with genera: *Paratylenchus* and *Cacopaurus*.

There remain a few genera which clearly differ from those mentioned above in the structure and form of the body and various organ; we propose to separate them into separate families and subfamilies.

(4) Family *Dolichodoridae* fam. nova, with subfamily *Dolichodorinae* Chitwood et Chitwood, 1950, with genera *Dolichodorus* and *Belonolaimus*. Nematodes with a well separated head, a very long spear, a lobar bursa and spicules of a specific structure.

(5) Family *Macroposthoniidae* fam. nova, with subfamily *Macroposthoniinae* subfam. nova with typical genus *Macroposthonia*. Nematodes with a short body, a strongly annular cuticle, a degenerate spear. Oesophagus of the aphelenchoid type. In males bursa absent; spicules large, well-shaped.

(6) Family *Nemonchidae* fam. nova, with subfamily *Nemonchinae* subfam. nova, with typical genus *Nemonchus* Cobb, 1913. In these nematodes there is a characteristic strong cuticular structure of the head with large papillae in the shape of "cap"; a very large, powerful spear in the buccal cavity. Genital system in females and males double. Spicules large, strong. Gubernaculum present.

(7) Family *Atylenchidae* fam. nova, with subfamilies *Atylenchinae* subfam. nova, with typical genus *Atylenchus* Cobb, 1913. Here belongs one more genus, *Eutylenchus* Cobb, 1913. Nematodes with an annular cuticle, and bristles at the capital extremity. In males genital bursa absent. Spear well-developed.

(8) Family *Ecphyadophoridae* fam. nova, with subfamily *Ecphyadophorinae* subfam. nova, with typical genus *Ecphyadophora* de Man, 1921. Nematodes with a smooth cuticle, thin, long. Spear well-developed, with basal swellings. Males with a genital bursa in the shape of narrow wings at the level of the cloaca; bursa with sharp processes in the shape of a tusk. Spicules thin, even. Gubernaculum absent.

(9) Family *Jotonchidae* fam. nova, with subfamilies *Jotonchinae* Goodey, 1953 with typical genus *Jotonchium* Cobb, 1920. Nematodes with specifically built complex spicules. These nematodes live in fungi.

Thus we assign the representatives of the order *Tylenchida* to two suborders: *Heteroderata* and *Tylenchata*. Suborder *Heteroderata* with one family, five subfamilies and seven genera; suborder *Tylenchata* with nine families, fifteen subfamilies and thirty-four genera.

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STRESZCZENIE

Autorka przedstawia krótko historię systemu nicieni — pasożytów roślin. Przeprowadzone w niedawnych latach rewizje Thorne'a i Chitwood'a okazują się dziś nie wystarczające. Autorka postawiła sobie za zadanie takie uporządkowanie systemu w obrębie rzędu *Tylenchida,* by obejmował on wszystkie znane rodziny, podrodziny i rodzaje nicieni posiadających sztylecik. Wyodrębnia ona podrząd *Heteroderata.* W rodzinie *Heteroderidae* Skarbilovich, 1947 wyróżnia nową podrodzinę *Meloidogyninae.* Rodzaj *Heterodera* Schmidt, 1871 dzieli na dwa podrodzaje: *Heterodera* i *Globodera.* Przeprowadzając rewizję podrzędu *Tylenchata* Chitwood et Chitwood, 1950, autorka wyróżnia 6 nowych rodzin: *Dolichodoridae, Nemonchidae, Macroposthoniidae, Atylenchidae, Ecphyadophoridae* i *Jotonchidae.*

Oprócz diagnoz poszczególnych jednostek systematycznych autorka podaje klucz do oznaczania podrodzin rodziny *Heteroderidae.*